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17PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2018
Engineering Physics

Time: 3 hrs.

Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing one full question from each module.*
2. *Physical constants : $C = 3 \times 10^8$ m/s , $h = 6.63 \times 10^{-34} JS$, $K = 1.38 \times 10^{-23} J/K$, $m = 9.11 \times 10^{-31} kg$, $e = 1.6 \times 10^{-19} C$, $NA = 6.02 \times 10^{26} kmol$.*

Module-1

1 a. Define a black body. Deduce Wien's law and Rayleigh Jeans law from Planks law of Radiation. **(07 Marks)**
   b. Set – up One dimensional time independent Schrodinger wave equation. **(06 Marks)**
   c. Explain the energy distribution in the spectrum of Black body. **(03 Marks)**
   d. An electron is bound in one dimensional potential well of width 0.12nm. Find the energy values in the ground state and also in first two excited states. **(04 Marks)**

OR

2 a. State Heisenberg's Uncertainty Principle. Show that free electrons cannot exist inside the nucleus. **(07 Marks)**
   b. Define Phase Velocity and Group Velocity. Derive the relation between them. **(06 Marks)**
   c. Write a note on Compton effect. **(03 Marks)**
   d. A particle of mass $0.65 MeV/C^2$ has free energy 120MeV. Find its deBroglie wavelength. [Where 'C' is speed of light]. **(04 Marks)**

Module-2

3 a. What is Fermi Factor? Discuss the variation of Fermi factor with temperature. **(07 Marks)**
   b. What is Superconductivity? Explain Type – I and Type – II superconductors. **(06 Marks)**
   c. Define : i) Mean collision time   ii) Relaxation time   iii) Drift velocity. **(03 Marks)**
   d. Find the probability that an energy level at 0.2eV below fermi level being occupied at temperatures 300K and 1000K. **(04 Marks)**

OR

4 a. Derive the expression for electrical conductivity by using Quantum free electron theory in case of metals. **(07 Marks)**
   b. Explain the failures of CFET. (Classical Free Electron Theory). **(06 Marks)**
   c. Write a note on High temperature superconductors. **(03 Marks)**
   d. The electron and hole mobilities of silicon are 0.14 $m^2V^{-1}S^{-1}$ and 0.05 $m^2V^{-1}S^{-1}$ respectively at a certain temperature. If the electron density is 1.5×10^{16} electrons/m^3 then calculate the resistivity of silicon. **(04 Marks)**

Module-3

5 a. Obtain an expression for energy density of radiation in terms of Einsteins co-efficient. **(07 Marks)**
   b. Write a note on different types of optical fibers. **(06 Marks)**
   c. Mention any three applications of LASERS. **(03 Marks)**
   d. Calculate the Numerical aperture, V – number and and number of modes in an optical fibre of core diameter 50µm. Refractive indices are 1.41 and 1.40 respectively at wavelength of 820nm. **(04 Marks)**

OR

6 a. Explain the construction and working of CO_2 Laser with the help of energy level diagram.
    (07 Marks)

   b. What is Holography? With a neat diagram, explain the recording and reconstruction process of a Hologram.
    (06 Marks)

   c. Define : i) Numerical Aperture   ii) Angle of Acceptance   iii) Attenuation. **(03 Marks)**

   d. Find the ratio of the populations of the two states in a material that produces light of wavelength 6328 $\overset{0}{A}$ at 27^0C.
    (04 Marks)

Module-4

7 a. What are Miller Indices? Derive an expression for Interplanar distances in terms of Miller Indices.
    (07 Marks)

   b. Explain Bragg's X – ray Spectrometer. **(06 Marks)**

   c. Define : i) Unit cell   ii) Bravaice Lattice   iii) Primitive cell. **(03 Marks)**

   d. Draw the following planes in a cubic unit cell :
    i) (1 1 1)   ii) (0 2 0)   iii) (1 $\bar{1}$ 2)   iv) (3 0 1). **(04 Marks)**

OR

8 a. Explain in brief the Seven Crystal systems, with neat diagrams. **(07 Marks)**

   b. Explain the crystal structure of diamond. **(05 Marks)**

   c. Calculate APF for BCC and FCC structures. **(04 Marks)**

   d. X – rays are diffracted in the first order from (110) plane of cubic crystal with lattice constant 3.036 $\overset{0}{A}$ at a glancing angle 9.6^0. Calculate the wavelength of X – rays. **(04 Marks)**

Module-5

9 a. What are Shock waves? Explain the construction and working of Reddy Shock tube.
    (07 Marks)

   b. What are Nano materials? Explain the Sol – gel method of synthesis of nano materials.
    (06 Marks)

   c. Mention four applications of shock waves. **(04 Marks)**

   d. Calculate the wavelength of an electron accelerated under a potential difference of 100V in SEM.
    (03 Marks)

OR

10 a. Explain the principle, construction and working of Scanning Electron Microscope.
    (07 Marks)

   b. Define Carbon Nanotubes (CNTs). Discuss pyrolysis method of obtaining CNTs.
    (06 Marks)

   c. Mention three applications of CNTs. **(03 Marks)**

   d. Distinguish between Acoustic, Ultrasonic , Subsonic and Supersonic waves. **(04 Marks)**

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